CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: February 5, 2020 FILE REF: 3400

TO: File

FROM: Woody Myers - WCR

SUBJECT: Saputo Cheese USA Inc (Almena) - Groundwater Evaluation Report, WPDES Permit # WI-0050725

Effluent & Groundwater Evaluation Summary

Effluent Land Disposal

Parameter	Unit	Current Permit WI-0050725-08		Proposed Permit WI-0057025-09	
		Limit	Frequency	Limit	Frequency
Flow Rate	MGD	-	Daily	-	Daily
BOD_5, Total	mg/l	-	Monthly	-	Monthly
Chloride*	mg/l	-	Monthly	300	Monthly
Total Nitrogen	mg/l	-	Monthly	-	Monthly
Total Dissolved Solids	mg/l	-	Monthly	-	Monthly
Nitrogen Max Applied per Zone	lbs/ac/yr	N/A	N/A	400	Annually

* Proposed permit change

Monitoring Wells

Well ID	Well Standard	Well Position	Aquifer
801 Well 1	Point of Standard	Down-gradient	Deep
802 Well 2	Non-Point of Standard	Mid-gradient	Deep
805 Well 2E	Background	Up-gradient	Deep
806 Well 3E	Point of Standard	Mid-gradient	Shallow
807 Well 5	Point of Standard	Down-gradient	Shallow
809 Well 7	Non-Point of Standard	Mid-gradient	Shallow
810 Well 8	Non-Point of Standard	Mid-gradient	Shallow
811 Well 9	Point of Standard	Mid-gradient	Shallow
812 Well 10	Non-Point of Standard	Up-gradient	Shallow
813 Well 7P	Non-Point of Standard	Mid-gradient	Deep
814 Well 8P	Non-Point of Standard	Mid-gradient	Deep
815 Well 11	Non-Point of Standard	Up-gradient	Deep
816 Well 6R	Non-Point of Standard	Down-gradient	Deep
817 Well 12	Non-Point of Standard	Up-gradient	Deep
818 Well 13	Non-Point of Standard	Up-gradient	Deep

Groundwater Standards

Parameter	Current Permit WI-0050725-08		Proposed WI-0050725-09	
	PAL	ES	PAL	ES
Depth to Groundwater	N/A	N/A	N/A	N/A
Groundwater Elevation	N/A	N/A	N/A	N/A
Chloride	176 mg/l (ACL)	250 mg/l	180 mg/l (ACL)	250 mg/l
Nitrogen, Nitrite + Nitrate	2.5 mg/l (ACL)	10.0 mg/l	2.5 mg/l (ACL)	10.0 mg/l
pH	5.7-7.7 su	N/A	6.0-8.0 su	N/A
Nitrogen, Ammonia	0.97 mg/l	9.7 mg/l	0.97 mg/l	9.7 mg/l
Nitrogen Total Kjeldahl	N/A	N/A	N/A	N/A
Nitrogen, Organic	2.5 mg/l	N/A	2.5 mg/l	N/A
Total Dissolved Solids	411 mg/l	N/A	460 mg/l	N/A
Total Dissolved Nitrogen	5.6 mg/l	N/A	5.6 mg/l	N/A

Site Information

The Saputo Cheese USA Inc (Almena) facility is located at 1052 6th Street, Almena, Barron County. This is an industrial wastewater treatment system facility. Wastewater is currently treated and discharged to groundwater via one of six spray irrigation fields. These land treatment systems are located in the SW ¼ of the NW ¼ of Section 7, the NW ¼ of the SE ¼ of Section 12 and NW ¼ of the NE ¼ of Section 13, T33N, R13W, Town of Twin Town.

Geology

The bedrock under this facility is the Trempealeau Group, which is comprised of the Jordan and St. Lawrence Formations. The Jordon Formation is comprised of the Coon Valley, Van Oser and Norwalk Members and the St. Lawrence is comprised of the Lodi Member. The St. Lawrence formation is comprised dolomite and the Jordan is comprised of sandstone. Bedrock was encountered during installation of the groundwater monitoring wells approximately 80 feet below ground surface (bgs). The regolith consists of material ranging fine to medium sand with occasional gravel and cobbles. Surface soil primarily consists of the Freeon silt loam and the Magnor silt loam.

Hydrogeology

Calculated groundwater elevation ranges between 1169 and 1174 feet above mean sea level (msl). Depth to groundwater was reported to be between 30 and 112 feet bgs. This facility has wells at the top of the piezometric surface (water table wells) and wells screened below the water table (piezometers). Due to presence of these different well depths and their locations two groundwater directions can be calculated; a shallow flow direction and a deep flow direction. Both the shallow and deep groundwater flow directions were calculated to be predominantly to the west south west. The vertical gradient was estimated to be very slight. Region groundwater is to the south in this area of Barron County. The site is directly adjacent (to the east) of Musket Lake and adjacent to a tributary system of an unnamed creek that eventually discharges to the Hay River.

Hydraulic and Nitrogen Loading Rates

There are eight active outfalls at this facility. Outfalls 001, 007, 008, 009, 010 and 0012 are the discharges associated with the groundwater monitoring network.

Sampling Point (Outfall) Listed in SWAMP		
Number	**Outfall Type**	**Description**
Outfall 001	Land Treatment	
Outfall 002 (emergency)	Surface Water	Hay River
Outfall 003	Land Application	High Strength Wastewater
Outfall 004	Land Application	Industrial Sludge
Outfall 007	Land Treatment	Spray Irrigation Field A
Outfall 008	Land Treatment	Spray Irrigation Field B
Outfall 009	Land Treatment	Spray Irrigation Field C
Outfall 011	Land Treatment	Spray Irrigation Field E
Outfall 012	Land Treatment	Spray Irrigation Field F

The following table is the average flow (hydraulic loading) and total nitrogen and chloride loading summations for the Land Treatment System.

Averages			
Year	**Flow (MGD)**	**Nitrogen (mg/l)**	**Chloride (mg/l)**
2019	0.343	79.7	418.0
2018	0.260	45.7	309.8
2017	0.212	29.2	488.2
2016	0.243	26.3	263.3
2015	0.244	86.5	208.6

Groundwater Monitoring Network and Frequency

Groundwater samples were to be collected quarterly from all of the wells listed below. Well 2E (805) is a background well and was used to calculate Preventative Action Limits (PAL) and Alternate Concentration Limits (ACL). Well 1 (801), Well 3E (806) Well 5 (807) and Well 9 (811) were sampled as "Point of Standard" or compliance wells.

Well Name	Well Number	Casing Top	Ground Surface	Screen Top	Screen Bottom	Screen Length	Well Type
Well 1	801	1252.20	1250.2	1162.2	1157.2	5.0	P
Well 2	802	1218.98	1217.0	1167.0	1162.0	5.0	P
Well 2E	805	1231.98	1229.5	1166.5	1156.5	10.0	P
Well 3E	806	1268.28	1266.3	1172.3	1162.3	10.0	WT
Well 5	807	1251.56	1249.1	1167.1	1157.1	10.0	WT
Well 7	809	1198.72	1197.0	1175.0	1165.0	10.0	WT
Well 8	810	1230.56	1228.5	1174.5	1164.5	10.0	WT
Well 9	811	1242.16	1240.6	1174.6	1159.6	15.0	WT
Well 10	812	1199.77	1197.2	1170.2	1160.2	10.0	WT
Well 7P	813	1199.10	1196.2	1141.2	1136.2	5.0	P
Well 8P	814	1233.02	1230.7	1142.7	1137.7	5.0	P
Well 11	815	1239.94	1237.4	1169.0	1154.0	15.0	P

Well 6R	816	1277.92	1275.4	1165.4	1150.4	15.0	P
Well 12	817	1258.47	1255.7	1165.7	1150.7	15.0	P
Well 13	818	1230.70	1227.9	1162.9	1147.9	15.0	P

All measurements in feet
WT-Water table Observation P-Piezometer O-Other

The groundwater samples are analyzed for the following parameters; Nitrite + Nitrate, Chloride, Ammonia, Organic Nitrogen, Kjeldahl Nitrogen pH, Total Nitrogen and Total Dissolved Solids (TDS). All of these parameters are analyzed for the aqueous or dissolved phase in groundwater. Established groundwater quality standards are found in s. NR140. 10 Table 1 Public Health Groundwater Quality Standards, and NR140.12 Table 2 Public Welfare Groundwater Standards. The thresholds of these standards are the Enforcement Standard (ES) and the PAL.

Groundwater Standards - Current Permit WI-0050725-08

Parameter	**PAL**	**ES**	**Source**
Depth to Groundwater	N/A	N/A	Measured
Groundwater Elevation	N/A	N/A	Measured
Chloride	176 mg/l (ACL)	250 mg/l	Calculated, Table 2, NR 140
Nitrogen, Nitrite + Nitrate	2.5 mg/l (ACL)	10.0 mg/l	Calculated, Table 1, NR140
pH	5.7-7.7 su	N/A	Calculated
Nitrogen, Ammonia	0.97 mg/l	9.7 mg/l	Table 1, NR 140
Total Kjeldahl Nitrogen	N/A	N/A	Measured
Nitrogen, Organic	2.5 mg/l	N/A	Calculated
Total Dissolved Nitrogen	5.6 mg/l	N/A	Calculated
Total Dissolved Solids	411 mg/l	N/A	Calculated

Groundwater Conditions and Exceedances

Groundwater sampling results from this facility have been analyzed for each well to evaluate trends of regulated compounds in groundwater and to calculate PALs and ACLs where appropriate. The groundwater was evaluated by looking at approximately five years of monitoring results. PALs and ACLs are calculated from this time range.

The compounds with exceedances are; chloride, nitrogen series compounds and TDS. All of these compounds exceeded the PAL. Nitrite + nitrate and chloride exceeded the ES in multiple wells. This evaluation will focus mainly on the nitrite + nitrate and chloride exceedances.

Chloride exceedances were predominately observed in wells; Well 5 (807), Well 8 (810), Well 8P (814) and Well 11 (815). There were sporadic exceedances in three other wells. The chloride concentration in groundwater was evaluated using a “best fit” linear trend line. A Y-slope intercept form was used (equation on graph). See Figure 1. The trend line in Well 5 (807) for dissolved chloride has a positive slope, meaning the trend (concentration) is increasing over time. It is common to see elevated levels of TDS where there are elevated levels of chloride. This is a point of standard well. Well 11 (815) has ES exceedances early in this permit term, but the concentrations are consistently below the PAL. See Figure 1. Well 8 (810) and Well 8P (814) were evaluated in depth. See Figure 2. Both wells exceeded the ES at times. The trend line in Well 8 (810) and Well 8P (814) for dissolved chloride have a negative slope, meaning the trend (concentration) is decreasing over time.

Nitrite + nitrate was observed regularly exceeding the PAL in most of the wells. Well 10 (812) and Well 12 (817) had multiple ES exceedances. Well 1 (801) samples exceeded the PAL consistently during the sampling period. See Figure 3. The trend has a positive slope (increasing over time). This well is a point of standard well and is down-gradient of the lagoons. Well 5 (807) has an increasing trend over time. See Figure 4. The results first exceeded the PAL in mid-2017. Well 10 (812) exceeded the ES in 2016 and has not exceeded it since. (no Figure) This well still exceeds the PAL. Well 12 (817) has exceeded the ES for regular periods with periods of only PAL exceedances. The trend for this data is stable. See Figure 5.

There were other forms of nitrogen that had PAL exceedances. One of these forms, ammonia, had three exceedances in Well 8P (814) 2018 and 2019. Ammonia and Nitrite + nitrate are the only nitrogen compounds in ch. NR140.10 Table 1 Wis. Admin. Code.

The monitored groundwater exceedances trend summary is as follows:

Well 1 (801)

Nitrogen, Nitrite + Nitrate
20 of 20 samples exceeded the PAL
maximum: 7.9 mg/l minimum: 2.5 mg/l average: 5.9 mg/l

Nitrogen, Total
14 of 20 samples exceeded the PAL
maximum: 11.0 mg/l minimum: 0.9 mg/l average: 6.3 mg/l

TDS
2 of 20 samples exceeded the PAL
maximum: 508 mg/l minimum: 260 mg/l average: 332 mg/l

Well 2 (802)

Nitrogen, Nitrite + Nitrate
10 of 20 samples exceeded the PAL
maximum: 3.6 mg/l minimum: 1.6 mg/l average: 2.5 mg/l

Well 2E (805)

Nitrogen, Total
2 of 20 samples exceeded the PAL
maximum: 9.3 mg/l minimum: 0.2 mg/l average: 1.5 mg/l

Well 5 (807)

Chloride
18 of 20 samples exceeded the ES
1 of 20 samples exceeded the PAL
maximum: 613 mg/l minimum: 2.8 mg/l average: 406 mg/l

Nitrogen, Nitrite + Nitrate
10 of 20 samples exceeded the PAL
maximum: 5.3 mg/l minimum: 0.8 mg/l average: 2.6 mg/l

TDS
20 of 20 samples exceeded the PAL
maximum: 1752 mg/l minimum: 540 mg/l average: 1084 mg/l

Well 7 (809)

Chloride
2 of 10 samples exceeded the PAL
maximum: 232 mg/l minimum: 45 mg/l average: 97 mg/l

Nitrogen, Nitrite + Nitrate
9 of 10 samples exceeded the PAL
maximum: 7.4 mg/l minimum: 2.1 mg/l average: 5.5 mg/l

Nitrogen, Total
7 of 10 samples exceeded the PAL
maximum: 6.8 mg/l minimum: 2.1 mg/l average: 5.8 mg/l

TDS
3 of 10 samples exceeded the PAL
maximum: 758 mg/l minimum: 240 mg/l average: 433 mg/l

Well 8 (810)

Chloride
10 of 10 samples exceeded the ES
maximum: 359 mg/l minimum: 251 mg/l average: 287 mg/l

Nitrogen, Nitrite + Nitrate
5 of 10 samples exceeded the PAL
maximum: 6.8 mg/l minimum: 2.1 mg/l average: 2.4 mg/l

Nitrogen, Total
1 of 10 samples exceeded the PAL
maximum: 7.0 mg/l minimum: 0.9 mg/l average: 3.3 mg/l

TDS
9 of 10 samples exceeded the PAL
maximum: 1172 mg/l minimum: 340 mg/l average: 954 mg/l

Well 9 (811)

Chloride
2 of 10 samples exceeded the PAL
maximum: 208 mg/l minimum: 26 mg/l average: 92 mg/l

Nitrogen, Nitrite + Nitrate
2 of 10 samples exceeded the PAL
maximum: 4.6 mg/l minimum: 1.7 mg/l average: 2.8 mg/l

Nitrogen, Total
1of 10 samples exceeded the PAL

maximum: 5.9 mg/l minimum: 1.6 mg/l average: 3.0 mg/l

TDS
6 of 10 samples exceeded the PAL
maximum: 636 mg/l minimum: 243 mg/l average: 433 mg/l

Well 10 (812)

Nitrogen, Nitrite + Nitrate
4 of 20 samples exceeded the ES
15 of 20 samples exceeded the PAL
maximum: 16.0 mg/l minimum: 2.0 mg/l average: 7.2 mg/l

Nitrogen, Organic
2 of 10 samples exceeded the PAL
maximum: 19.0 mg/l minimum: 0.2 mg/l average: 1.8 mg/l

Nitrogen, Total
15 of 20 samples exceeded the PAL
maximum: 28.0 mg/l minimum: 2.2 mg/l average: 8.9 mg/l

Well 7P (813)

Chloride
1 of 10 samples exceeded the ES
1 of 10 samples exceeded the PAL
maximum: 259 mg/l minimum: 61 mg/l average: 126 mg/l

Nitrogen, Nitrite + Nitrate
10 of 10 samples exceeded the PAL
maximum: 7.1 mg/l minimum: 5.6 mg/l average: 5.6 mg/l

Nitrogen, Organic
1 of 10 samples exceeded the PAL
maximum: 3.3 mg/l minimum: 0.2 mg/l average: 0.9 mg/l

Nitrogen, Total
8 of 10 samples exceeded the PAL
maximum: 9.0 mg/l minimum: 2.7 mg/l average: 6.2 mg/l

TDS
5 of 10 samples exceeded the PAL
maximum: 732 mg/l minimum: 216 mg/l average: 443 mg/l

Well 8P (814)

Chloride
3 of 10 samples exceeded the ES
2 of 10 samples exceeded the PAL
maximum: 282 mg/l minimum: 151 mg/l average: 204 mg/l

Nitrogen, Ammonia
3 of 10 samples exceeded the PAL
maximum: 1.9 mg/l minimum: 0.04 mg/l average: 0.83 mg/l

Nitrogen, Nitrite + Nitrate
9 of 10 samples exceeded the PAL
maximum: 4.5 mg/l minimum: 1.7 mg/l average: 3.4 mg/l

Nitrogen, Total
2 of 10 samples exceeded the PAL
maximum: 8.6 mg/l minimum: 0.9 mg/l average: 4.1 mg/l

TDS
9 of 10 samples exceeded the PAL
maximum: 1060 mg/l minimum: 288 mg/l average: 740 mg/l

Well 11 (815)

Chloride
6 of 20 samples exceeded the ES
1 of 20 samples exceeded the PAL
maximum: 412 mg/l minimum: 58 mg/l average: 158 mg/l

Nitrogen, Nitrite + Nitrate
19 of 20 samples exceeded the PAL
maximum: 6.0 mg/l minimum: 1.8 mg/l average: 4.0 mg/l

Nitrogen, Total
2 of 20 samples exceeded the PAL
maximum: 8.4 mg/l minimum: 0.3 mg/l average: 4.3 mg/l

TDS
14 of 20 samples exceeded the PAL
maximum: 1296 mg/l minimum: 292 mg/l average: 660 mg/l

Well 6R (816)

Nitrogen, Nitrite + Nitrate
20 of 20 samples exceeded the PAL
maximum: 7.5 mg/l minimum: 2.4 mg/l average: 4.7 mg/l

Nitrogen, Organic
5 of 20 samples exceeded the PAL
maximum: 4.6 mg/l minimum: 0.2 mg/l average: 1.3 mg/l

Nitrogen, Total
7 of 20 samples exceeded the PAL
maximum: 10.0 mg/l minimum: 1.1 mg/l average: 5.3 mg/l

TDS
2 of 20 samples exceeded the PAL
maximum: 604 mg/l minimum: 148 mg/l average: 269 mg/l

Well 12 (817)

Nitrogen, Nitrite + Nitrate
12 of 20 samples exceeded the ES
6 of 20 samples exceeded the PAL
maximum: mg/l minimum: 3.3 mg/l average: 22.0 mg/l

Nitrogen, Organic
3 of 20 samples exceeded the PAL
maximum: 3.5 mg/l minimum: 0.2 mg/l average: 1.1 mg/l

Nitrogen, Total
19 of 20 samples exceeded the PAL
maximum: 23.0 mg/l minimum: 0.9 mg/l average: 12.3 mg/l

TDS
14 of 20 samples exceeded the PAL
maximum: 548 mg/l minimum: 236 mg/l average: 419 mg/l

Well 13 (818)

Nitrogen, Nitrite + Nitrate
19 of 20 samples exceeded the PAL
maximum: 5.2 mg/l minimum: 2.1 mg/l average: 4.1 mg/l

Nitrogen, Organic
1 of 20 samples exceeded the PAL
maximum: 2.8 mg/l minimum: 0.2 mg/l average: 0.7 mg/l

Nitrogen, Total
4 of 20 samples exceeded the PAL
maximum: 6.7 mg/l minimum: 2.1 mg/l average: 4.6 mg/l

Concentrations and trends in the groundwater monitoring data were compared to the loading data for the land treatment system. There were no clear correlations.

Proposed Groundwater Monitoring Requirements

The groundwater monitoring wells; Well 1 (801), Well 2 (802), Well 2E (805), Well 3E (806), Well 5 (807), Well 7 (809), Well 8 (810), Well 9 (811), Well 10 (812), Well 7P (813), Well 8P (814), Well 11 (815), Well 6R (816), Well 12 (817) and Well 13 (818) should be sampled quarterly for the parameters in the table below. The groundwater limits were calculated using the background well Well 2E (805) data. Well 1 (801), Well 3E (806) Well 5 (807) and Well 9 (811) are to be sampled as ch. NR140.22 Wis. Admin. Code Point of Standard wells.

Proposed Groundwater Standards –Permit WI-0050725-09

Parameter	PAL	ES	Source
Depth to Groundwater	N/A	N/A	Measured
Groundwater Elevation	N/A	N/A	Measured
Chloride *	180 mg/l (ACL)	250 mg/l	Calculated, Table 2, NR 140
Nitrogen, Nitrite + Nitrate	2.5 mg/l (ACL)	10.0 mg/l	Calculated, Table 1, NR140
pH *	6.0-8.0 su	N/A	Calculated
Nitrogen, Ammonia	0.97 mg/l	9.7 mg/l	Table 1, NR 140
Total Kjeldahl Nitrogen	N/A	N/A	Measured
Nitrogen, Organic	2.5 mg/l	N/A	Calculated
Total Dissolved Nitrogen	5.6 mg/l	N/A	Calculated
Total Dissolved Solids *	460 mg/l	N/A	Calculated

The chloride, pH and TDS ACL PALs were modified from the previous permit groundwater limits. The increase proposed is due to change in trends of the background well.

Conclusions

The slight vertical gradient does not appear to be present, but there does appear to be enough dilution and dispersion to adequately mix the discharged compounds uniformly.

The chloride contamination appears to be stable in most wells apart from Well 5(807). Given the groundwater sampling results and the annual loading averages a recommendation of a 300 mg/l effluent limit is advised; particularly for spray filed F. Nitrite + nitrate is consistently above the (ACL) PAL ,with some ES exceedances. Well 1 (801) and Well 5 (807) have been consistently increasing in concentration. It is recommended that efforts be evaluated to optimize the spray irrigation fields including load-rest cycles and crop removal periods. If these are at the optimum, then an effluent limit maybe needed.

There are no down gradient wells of fields E and H. Other than this discrepancy the wells appear to be placed adequately; including an adequate up-gradient well.

Overall the facility is found to be substantially compliant.